fixed, variable, harvesting, and packing costs. These calculations assume no berries were rejected by the buyer. If some berries are rejected, costs will rise proportionally. As yield increases, the price required to cover total costs decreases.

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Proc. Fla. State Hort. Soc. 90:236-239. 1977.

MARKETING FLORIDA LIMES: RETAIL PRACTICES AND PROBLEMS WITH SUMMER MOVEMENT

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Additional index words. merchandising, promotion.

Abstract. **Produce merchandisers of major food retailers in Chicago and Los Angeles were interviewed to determine retail marketing practices and problems associated with fresh Florida limes and to identify ways to increase retail lime sales during the summer months, the peak production period. Few physical handling problems were discovered. The consensus was that Florida limes are preferred over limes from other areas because of superior quality. However, limes were found to represent an extremely small proportion of produce department sales. Consequently, limes are given relatively little attention by retailers. Florida lime growers and shippers could increase retail interest by special promotions and improved communications with merchandisers. Additional research on consumer characteristics is also needed.**

Florida produces most of the limes grown in the United States, with over 90% of domestic acreage and production. Florida has held this dominant position for 50 years, as production of the 'Persian' or 'Tahiti' lime supplanted the 'Mexican' or 'Key' lime following the 1926 hurricanes (6). From 9,800 bushels in 1928, Florida lime production has increased to about 1 3/4 million bushels[1] currently (4).

Bearing acreage increased 18% from 1968-69 to 1975-76, while production rose 57% over the same period. Total value more than doubled over those 7 seasons, increasing from $3 million to $10 million (4). Recent projections show lime acreage increasing by about 5% from 1973 to 1985, with total production expected to go up by 30% in the absence of hurricanes or other natural disasters (7). Increased production in the past 5 years and prospects for further growth are of concern to lime growers and shippers.

The seasonal nature of lime marketing and the resulting variation in grower prices also has major effects. From 1971-72 through 1975-76, total production ranged from 1,680,000 to 1,760,000 bushels, with certified fresh shipments varying between 711,000 and 895,000 bushels. Over these 5 seasons, an average of 62% of the season's crop was marketed during the five-month period of May through September and 41% during June, July, and August (10). Volume increases sharply during May to a summer peak, then declines substantially. Prices vary in the opposite direction from shipments (11), with a sharp drop in price in May, and an increase in the fall from the low summer level (Fig. 1). Over the five-season period, 1971-72 to 1975-76, July prices were about one-third those in April, with March prices averaging nearly 4 times July levels (5).

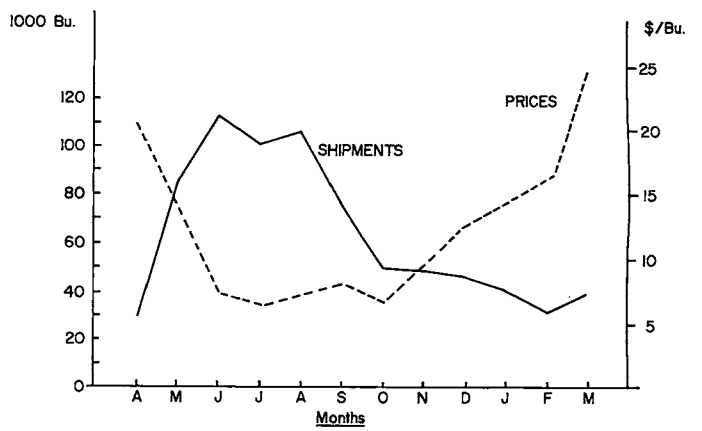

Fig. 1. Florida limes, fresh sales: average monthly shipments and average monthly prices, 1971/72-1975/76.

An average of 53% of the total lime crop was diverted to processing uses during the 1971-72 to 1975-76 period. This proportion ranged from 57% in 1971-72 to 46% in 1975-76. Grower returns on processing fruit have been negative for the past several seasons.

Florida growers are facing the problems of heavy volume and low prices for fresh limes in the summer months, losses on processing fruit, and anticipated increases in the lime crop in coming years. The objectives of this study were to determine retail practices and problems with fresh Florida limes and to identify ways to increase retail lime sales during the summer months.

Procedure

Structured interviews were conducted with produce merchandisers and buyers in corporate or regional offices of retail chains or voluntary retail cooperatives in Chicago and Los Angeles. Executives in 19 retail organizations were interviewed during September and October, 1976.

Los Angeles and Chicago were selected because they are the second and third leading U.S. markets for fresh Florida

Florida Agricultural Experiment Station Journal Series No. 767.
[1]*One bushel* = 50 pounds (22.69 kilograms).

limes (9). In both Chicago and Los Angeles a relatively small number of retail food firms account for a high proportion of food sales. Thus, firms were selected on the basis of their relative importance in the respective markets as evidenced by published estimates of their market shares (9), as shown in Table 1.

Table 1. Number of retail stores and market shares for grocery firms included in lime marketing study, Chicago and Los Angeles, 1976.

Market area	Firms	Stores	Share of grocery sales in market area
	No.	No.	%
Chicago	8	1,377	83
Los Angeles	11	1,417	84
Total	19	2,794	—

Source: (1, 2, 9), interviews.

Findings

Research findings are discussed under two major sections: retail merchandising practices, and retailers' suggestions for improving lime marketing. All retailers interviewed stated that Florida limes are superior in size, color and keeping quality and are preferred overwhelmingly to limes from other area. A few California firms will carry only California limes when they are in season, but even those retailers stated that Florida limes were higher quality (3).

Retail merchandising practices

A major portion of the study was devoted to determining prevailing merchandising practices and problems for fresh limes. The topics explored were (1) product availability at the retail level, (2) types of packaging used, (3) the nature and allocation of display space and (4) pricing, price specials and other promotions.

Product availability. All retail firms contacted handle fresh limes on a year-round basis. Produce merchandisers of the major chains generally felt that occasional out-of-stock conditions occurred especially in late winter when lime prices were generally highest. However, most thought that the stores which temporarily stopped handling limes during such periods generally had low lime sales. Such stores were typically described as "low-volume" and/or "low-income." Produce merchandisers emphasized that stores where a large proportion of the clientele was black typically have low lime sales, but said Latin areas are among the best for lime sales, along with high-volume stores and those in high-income areas.

Packaging methods used at retail are the same in Chicago and Los Angeles. Packages, either a tray overwrap or a polyethylene bag, usually contain from two to eight limes. Stores rarely sell limes both in bulk and in packages simultaneously. However, it is not uncommon to find some stores in a firm offering limes in bulk, while other stores in the same firm are displaying packaged fresh limes.

Two firms in Chicago sell fresh limes in bulk only throughout the year, while one firm always packages them. The remaining 5 firms use both methods, usually at different times of the year or in different stores. Seven of the 11 Los Angeles firms, all major retail chains, sell fresh limes only in bulk the year-round. Only one packages limes all year.

Display space. Most Chicago retailers display limes in refrigerated sections of the produce department, but in Los Angeles about half used refrigerated space and half non-refrigerated displays. The normal amount of display space allocated to fresh limes was found to be similar in the 2 cities, although there were some differences in general merchandising procedures. The general pattern in Chicago is for stores to display from 5 to 10 pounds of fresh limes (in bulk) adjacent to lemons or other citrus fruit to "break color." When limes are packaged, the typical store will display about 15 to 20 packages. One voluntary cooperative chain merchandiser said that many of his stores display limes in the 10-pound shipping container[2], which results in a display area of slightly less than one square foot.

There was considerable uniformity among retailers in Los Angeles with regard to amount of display space and merchandising techniques. Nine of the eleven firms use small rattan, wire or plastic baskets, which hold about 10 to 15 pounds of limes. Most Los Angeles firms increase display space for limes by varying amounts in conjunction with price specials. Some stores double space during specials. Where normal display space is "basket size," larger retailers reported that low retail prices (5¢ to 7¢ each) usually encourage larger displays which hold from 20 to 75 pounds. Such large displays are infrequent, however.

Only 2 of the Chicago firms use special retail displays or other produce tie-ins for fresh limes. One produce merchandiser displays limes in small wire basket extensions near cash registers in liquor departments. Another incorporates fresh limes into a "tropical fruit" display.

Los Angeles retailers reported greater use of special displays and tie-ins. Special displays generally focus on limes only when they are on special at low retail prices. However, 6 merchandisers said that limes had been incorporated into special displays which featured "gourmet", "Mexican", "Hawaiian", or "International" themes. When these special themes are used, limes are displayed along with tropical items such as mangoes, pineapples, lemons, tamarinds and chili peppers. One firm also uses bar tools such as lime squeezers as tie-in items. Merchandisers were unable to give assessments of the effectiveness of the special theme efforts on lime ales, but the consensus was that they help move limes.

Pricing and specials. Retail pricing methods, and margins or markups for limes and lemons were covered, as well as the frequency of price specials. Retailers in the Chicago area price limes in multiples—3 for 39¢, 6 for 59¢, etc.—except in stores within the Chicago city limits, where ordinances require pricing by the pound for nearly all produce items. More Los Angeles area retailers price limes on an individual or unit basis than in multiples (Table 2). Two Los Angeles firms priced limes by the pound only when prices were at high levels, while another priced by the pound when he considered quality to be low.

Most firms contacted used the same methods for pricing lemons as they used for limes. Actual prices for each fruit and difference between prices depended on wholesale market conditions and competition according to firm representatives interviewed.

Retail margins, as a percentage of retail price, were the same for limes and lemons in 14 of the 18 firms responding, and markup on limes was the same as on all produce items in nine firms (Table 3).

Some retailers reported taking smaller margins when lime prices were low, because volume was greater and shrinkage less than when prices were high. Generally, margins on limes were varied little during the year. Lime movement in relation to produce sales is small and merchandisers

[2]Florida limes are normally shipped in fiberboard cartons of three weights: 10 pounds (4.54 kilograms), 20 pounds (9.07 kilograms) and 38 pounds (17.24 kilograms).

Table 2. Pricing methods used by food retailers in Chicago and Los Angeles market areas, 1976.

Pricing method	Chicago	Los Angeles
	No. firms	
Unit	0	8
Multiple unit	7	5
Pound[z]	7	3

[z]Chicago retailers because of a city ordinance are forced to sell nearly all produce by the pound. Several Los Angeles retailers that sell fresh limes by the pound cited high prices as a primary reason. One gave poor quality as his reason.

do not concern themselves greatly with varying margins on limes.

The key point gained from retailers' responses on margins is that the markup on limes is comparable to the average for all produce items, and makes limes profitable to the retailer. Limes are thus an attractive item for retailers who would increase display space, if consumer purchases were increased.

Table 3. Gross margin on limes compared with lemons and all other produce, Chicago and Los Angeles market areas, 1976.

Margin on limes compared with:	Margin amount	Chicago	Los Angeles	Total
		No. firms		
Lemons	Same	6	8	14
	More	0	3	3
	Less	1	0	1
	Total	7	11	18
All produce	Same	5	4	9
	More	2	5	7
	Less	0	2	2
	Total	7	11	18

Retailers reported offering price specials on limes about 3 times during the summer and once or twice during the remainder of the year. Los Angeles area firms placed limes on special more frequently in the summer than did Chicago retailers. However, the Chicago area firms featured limes at special prices more often the rest of the year.

Actual price levels, or differences from earlier or "regular" prices, depended on wholesale prices and on competition, according to retailers. Several mentioned that, when their purchase prices allowed, retail prices of 5¢ or 10¢ each for limes attracted many consumers and substantially increased volume. Retailers' comments emphasized the psychological appeal to consumers of such low retail prices.

Only one retailer specifically mentioned large fluctuations in prices as a problem, while 3 others cited small supplies at certain times as restricting availability and consumer purchases. Most retailers felt that a certain proportion of their customers would purchase limes at even very high prices, and that many more consumers began using limes when prices dropped. It would be helpful from a marketing standpoint to determine if low retail prices result in attracting new or infrequent consumers or simply result in larger purchases by regular consumers.

The overall position of limes in a supermarket produce department is one of a low-volume specialty item. The following example illustrates why retailers are not greatly concerned about major merchandising efforts for limes. In Chicago, fresh lime volume per store ranged from 5 to 56 pounds per week and averaged about 14 pounds. Los Angeles retailers reported weekly store volume of 14 to 69 pounds with an average of nearly 29 pounds.

With an average shrinkage of 3.2% and a hypothetical retail price of 15¢ each for size 54's[3], the contribution of fresh limes to a store's gross sales would amount to only $1.21 per week in Chicago and $22.66 in Los Angeles. Considering that most firms operate on a gross markup (based on the retail price) of about 40%, fresh limes contribute only $4.48 and $9.06, respectively, to stores' gross profit in the two cities. One Los Angeles retailer reported that his lime sales typically constituted only 0.15% of his produce sales.

Increasing lime volume in the summer: retailers' views

Almost all retailers contacted stated that most consumers know only one way to use limes—in beverages. For consumers to buy more limes in the summer, they must be attracted by ideas and uses that are new and different to them. Only 2 retailers had no suggestions for increasing lime volume. The other 17 firm representatives interviewed stated that consumers would respond to suitable efforts that increased their awareness and knowledge of a wider range of uses for limes. Several respondents cited sales increases in avocados as "success stories" and several California retailers noted that pineapples and papayas had become well-established and widely accepted due to education-promotion efforts.

Though they had no research on the characteristics of lime users, retailers believe that high-income shoppers and and people of Spanish descent buy more limes than other groups of consumers. Retailers also felt that two groups would be most likely to respond to educational-promotional programs showing uses for limes other than with beverages, especially uses in cooking.

Retailers and wholesalers contacted suggested a number of ways to reach consumers. Recipes and point-of-sale material were mentioned most often. Several different recipes and price cards with attractive pictures showing different uses for limes were specific suggestions from retailers. Tie-ins were also mentioned as helpful. Promotions tying limes to beverages, and related items, were suggested.

Advertising and promotion were also cited as ways to increase lime movement in the summer. Those interviewed said that radio, television, newspaper, food pages, and magazines were all effective. Some of the Los Angeles retailers singled out radio as very effective, with more impact on consumer awareness, at lower cost, than other media.

Retailers and wholesalers interviewed also pointed to a need for greater awareness by members of the trade regarding the variety of uses for limes. They also suggested that more stable prices, at lower levels, would increase lime movement. One firm representative felt display contests would involve store produce managers and merchandisers, and increase lime sales in the summer.

Conclusions

A basic conclusion reached by this study is that the primary marketing problem faced by fresh limes is a lack of consumer knowledge about the product, rather than impediments at other points in the marketing channel. This is not to imply that other marketing considerations are unimportant, but identifies the consumer as the focal point of market development activities.

Limes are considered by retailers to be a low-volume, specialty item. Many large supermarkets carry from 100 to

[3]Size designations refer to the number of limes of a given size in a 10-pound carton.

250 produce items (8). Firms spend most of their promotion efforts on the top 25 or 30 moneymakers, and limes are not one of them. Volume figures for fresh limes cited earlier vividly reflect the marketing problem confronting the Florida lime industry. The small contribution that fresh limes typically make to produce departments' profitability (in absolute terms) explains merchandisers' lack of enthusiasm for and lack of knowledge about the product. Other produce items with greater volumes get the lion's share of their attention.

Trade relations

Although limes are available on a year-round basis, a special "lime season" promotion for the heavy volume portion of the year may get merchandisers' attention, and such a promotion could possibly foster a better understanding of the supply situation and improve good will. Some of the merchandisers were apparently unaware of the availability of larger fruit sizes. A "reminder" could possibly move additional quantities of limes and alleviate surpluses of larger sizes during peak production.

New or different display ideas and point-of-purchase materials are welcomed by most produce merchandisers. Besides providing Florida limes with greater trade visibility, merchandising efforts can be directed at educating consumers in expanded uses for fresh limes.

Special displays of tropical fruits which include limes and tie-ins with other items should be stressed. Occasional large displays of limes could possibly be encouraged through display contests for produce managers, if held during the peak availability period and if held in conjunction with price specials. However, efforts aimed at increasing "normal" display space for limes are doomed. Most merchandisers feel that they are already allocating sufficient or excessive space to fresh limes given current levels of consumer demand.

Point-of-purchase materials can provide a double-barreled promotional effect. Price cards, recipes, and similar items offer a means of getting retailers' attention and, if used, communicate directly with consumers.

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Proc. Fla. State Hort. Soc. 90:239-240. 1977.

SUITABILITY OF MANGO AS A LONG-TERM HOST OF THE CITRUS BLACKFLY[1,2]

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Additional index words. Aleurocanthus, lifetable, *Mangifera.*

Abstract. **I studied the developmental time and survivorship of the citrus blackfly,** Aleurocanthus woglumi **Ashby on mango,** Mangifera indica **L. (Anarcardiaceae). There was no significant difference in the developmental time as compared to a citrus control. However, survivorship was significantly ($p < 0.01$) poorer on mango. Of each cohort of 1706 eggs, 855 adults can be expected to emerge on citrus and only 40 on mango. Each female** A. woglumi **must lay 107 eggs for $R_o = 1$ on mango. The continued presence of** A. woglumi **on mango appears dependent upon constant immigration of gravid** A. woglumi **females from nearby infested citrus.**

Since its discovery in south Florida in 1976, the citrus blackfly *Aleurocanthus woglumi* Ashby (Homoptera: Aleyrodidae) has become the subject of a joint state-federal eradication effort and extensive research (1, 4, 6-8). In previous studies (7, 11) exotic and native plants of south Florida were screened for their ability to support complete development of *A. woglumi*. Recently I began studies to determine which of the previously studied non-citrus hosts are capable of sustaining populations of *A. woglumi*. Here my results dealing with the suitability of mango, *Mangifera indica* L. (Anarcardiaceae) as a long-term host of *A. woglumi* are reported.

Methods and Materials

I infested 'Hayden' mango trees (1.2-1.8 m tall) with *A. woglumi* by placing them within 1 m of an infested grapefruit (*Citrus paradisi* Macf.) tree for one week. This was done on 2 occasions in 1977 (February—5 trees and March—2 trees). They were then taken to the laboratory, placed in a 5 x 3 x 3 m screened room and watered and fertilized as needed. A 12 cm band of Tree Tanglefoot(R) was used around the trunk to exclude ants.

The number of egg spirals on the 7 trees were counted. I also followed the survivorship and development of 61 egg spirals (N = 1706 eggs) distributed among the plants infested in February. Each leaf harbored from 1-4 spirals and the *A. woglumi* on the leaves were censused weekly until all adults had emerged. From these data a life table of *A. woglumi* on

[1]Florida Agricultural Experiment Station Journal Series No. 780.
[2]I thank Bryan Steinberg for his help in this study.